

Summary of Available Options

	Capital High	Capital Low	Avg Operating Cost	HR Penalty	Max Removal %	IPP NOx
SNCR	\$35	\$18	\$7	0.5%	60	0.18
FLGR	\$15	\$13	\$10	0.5%	45	0.25
CGR	\$27	\$20	\$30	0.0%	50	0.18
Amine Enhanced FLGR	\$35	\$25	\$15	0.5%	70	0.14
Combined SNCR & CGR	\$72	\$30	\$37	0.5%	85	0.08
SCR	\$123	\$88	\$17	1.5%	90	0.05

Capital Cost is in Millions
 Operating Cost in Millions per year
 IPP Nox is Based on 0.45 lbs/MBTU Current
 Pipeline for Natural Gas is Not Included

EPA 2007 ~ 0.15 #/mwh

COST CALCULATION DETAILS

(TABLE 3)

Technology	Pre-control NOx Emissions (tons/yr)	Absolute Emission Factor (%) reduction)	Absolute Emission Reduction (tons/yr)	Minor Mod Emission Reduction (tons/yr)	Capital Costs (MM\$)	Unit Fixed O&M (\$/yr)	Total Fixed O&M (\$/KWh)	Unit Variable O&M (\$/MWh)	Total Variable O&M	Life N (yrs)	Interest Rate (%)	CRF	Absolute Annualized Cost	Absolute Cost Effectiveness (\$/ton removed)	Incremental Annualized Cost (\$/yr)	Incremental Cost for Minor Mod (\$/ton removed)
LNB	27,960	15	4,194		9.9	0.035	56,222	0.000	0	25	9	0.1018	1,064,104	254		
LNB w/OFA	27,960	50	13,980		22	0.048	77,640	0.131	1,853,000	25	9	0.1018	4,170,378	298		
SNCR	27,960	40	11,184		18.4	0.111	178,971	0.356	5,042,147	25	9	0.1018	7,094,353	634		
SCR	27,960	70	19,572		150	1.837	2,967,187	0.287	4,066,030	25	9	0.1018	22,304,155	1,140		
LNB	27,960			2777	9.9	0.04	64,600	0	0	25	9	0.1018			1,072,482	386
LNB w/OFA	27,960			2777	22	0.05	80,750	0	0	25	9	0.1018			2,320,488	836
SNCR	27,960			2777	18.4	0.111	179,265	0.089	1,259,119	25	9	0.1018			3,311,619	1,193
SCR	27,960			2777	150	1.84	2,971,600	0.14	1,980,636	25	9	0.1018			20,223,174	7,282

2yr Avg NOx emissions: 25,144 tons

Post-project uncontrolled NOx increase: 2,816 tons

Minor Mod Limit: 25144 + 40 tons (25,184)

Minimum Minor Mod decrease: 2,777 tons

Estimated Costs: Source Vendor Specific, with adjustments based on EPA's CUECost workbook.

		LNB	LNB w/OFA	SNCR	SCR
Fixed O&M	Oprtg Labor	22,489	31,056	98,550	518,882
	Maint Lbr & Cost	33,733	46,584	80,421	546,054
	Re- Capitaliztion Catalyst Bed				1,902,251
Unit O&M		0.03481	0.048074	0.110818	1.8372675
Variable O&M	Urea			5,032,800	
	Ammonia				2,362,500
	Disposal		520,000		38,440
	Power			1983	1,427,528
	Steam				237,562
	Water			7364	
	Lost Revenue		1,333,000		
Unit O&M		0	0.130978	0.356401	0.2874048

Capital Costs adjustments are from direct vendor information.

HP DENSE PACK UPRATE PROJECT - ECONOMIC CUT-OFF ANALYSIS

HP Dense Pack	\$ 9,400,000
Other Improvements / Debottlenecks	12,000,000
Avoided Costs (nozzle block, etc)	<u>-5,304,000</u>
	\$ 16,096,000

Payback Benefit (per year) \$ 35,784,704 NPV= -16096000 + 35784704 (P/A, i,N) = \$335,423,686

GO/NO GO criteria: Two year payback

Maximum allowable for NOx Control Installation:

$$35,784,704 \times 2\text{yrs} - 16,096,000 = \$ 55,473,408 \text{ (Present worth, not just capital)}$$

NOx Control Data

Given:	Capital Costs	O&M Annual Costs:	Economic Life	Cost of Money
LNB	\$9.9M	56,222	25 years	9%
LNB w/OFA	22M	1,930,640	25 years	9%
SNCR	18 4M	5,221,118	25 years	9%
SCR	150M	7,033,217	25 years	9%

Net Present Worth Calculations: (Capital outlay + benefit(P/A, i, N) - expense(P/A, i, N) (P/A, 9, 25) = 9 8225796

LNB	$-(\$16,096,000+9,900,000) + \$35,784,704 (P/A, 9, 25) - \$56,222 (P/A, 9, 25) =$
LNB w/OFA	$-(\$16,096,000+22,000,000) + \$35,784,704 (P/A, 9, 25) - \$1,930,640 (P/A, 9, 25) =$
SNCR	$-(\$16,096,000+18,400,000) + \$35,784,704 (P/A, 9, 25) - \$5,221,118 (P/A, 9, 25) =$
SCR	$-(\$16,096,000+150,000,000) + \$35,784,704 (P/A, 9, 25) - \$7,033,217 (P/A, 9, 25) =$

NPV Total	NPV Upstate	Difference	Cut-Off	Within Cut-off?
\$324,971,407	\$335,423,686	\$10,452,279	55,473,408	Y
\$294,458,656	\$335,423,686	\$40,965,029	55,473,408	Y
\$285,735,690	\$335,423,686	\$69,687,996	55,473,408	N
\$116,335,110	\$335,423,686	\$219,088,576	55,473,408	N

99*00/ave + upgrade: 27,960
 2yrave = 27,144

BACT
 5/2/01

COST CALCULATION DETAILS

Technology	Pre-control NOx Emissions (tons/yr)	Absolute Emission Factor (%) reduction)	Absolute Emission Reduction (tons/yr)	Minor Mod Emission Reduction (tons/yr)	Capital Costs (MM\$)	Unit Fixed O&M (\$/yr)	Total Fixed O&M (\$/KWh)	Unit Variable O&M - full use chemical only (\$/MWh)	Unit Variable O&M - minor mod- chemical only (\$/MWh)	Unit Variable O&M - other (\$/MWh)	Absolute - Total Variable O&M	Minor Mod - Total Variable O&M	Life N (yrs)	Interest Rate (%)	CRF	Absolute Annualized Cost	Absolute Cost Effectiveness (\$/ton removed)	Incremental Annualized Cost (\$/yr)	Incremental Minor Mod (\$/ton removed)
1 LNB	27,960	15	4194	2774	9.9	0.21	339150	0	0	0.04	565896	565896	25	9	0.1018	2432046	579.8869814	2432046	876.7289113
2 LNB w/OFA	27,960	60	16776	2774	35	0.29	468350	0	0	0.06	848844	848844	25	9	0.1018	7425194	442.6081307	7425194	2676.710166
3 SNCR	27,960	40	11184	2774	18.4	0.23	371450	0.177870139	0.044117647	0.05	3223770	1331520	25	9	0.1018	5774970	516.3599785	5774970	2081.820476
4 SCR	27,960	75	20970	2774	150	5.88	9496200	0.33350651	0.044117647	0.46	11226054	7131954	25	9	0.1018	24263154	1157.041202	24263154	8746.630858

Capital Recovery
 Factor

4.0m
 1/3 beat/year
 .35
 50/year

Include
 Table 4

ATTENTION: RAND CRAFTS 435-864-0994

RAND,

I HAVE THE FOLLOWING COMMENTS ON PARSON'S BACT REPORT

1. ECONOMIC LIFE FOR ALL PROJECTS SHOULD BE 25 YEARS. 3 YEARS WAS FOR LIFE OF CATALYST ~~ONLY~~ WHICH ONLY REPRESENTS ABOUT \$10,000,000 OF PROJECT. THIS WILL BE COVERED BY FIXED O&M.
2. CAPITAL COST FOR BURNERS SEEMS HIGH, THAT IS OUR \$182,000 FOR BURNER. ABOUT HALF THAT MUCH SHOULD BE ENOUGH.
3. I STILL DO NOT BELIEVE THERE IS ANY VARIABLE COST FOR BURNERS ALONE. FAN COSTS SHOULD BE ABOUT THE SAME AS CURRENT.
4. FIXED O&M SHOULD BE LOWER FOR LNB'S. \$200,000 PER YEAR WOULD BE PLenty.
5. DOES THE 3,625 TON REDUCTION NULL OUT INCREASE FROM INCREASED LOAD?
6. FIXED O&M FOR LNB'S W/OFA ALSO TOO HIGH.
7. FIXED O&M FOR SNCR WAY TOO HIGH THERE ARE ONLY A FEW PUMPS & NOZZLES TO MAINTAIN. \$250K WOULD STILL BE HIGH BUT REASONABLE.
8. VARIABLE COST FOR SNCR NOT ON THE SAME PLANET W/ ~~REALITY~~ REALITY. WITH 100% STOICHIOMETRY, 1 MOLE NH_3 REMOVES 1 MOLE NO . MOLECULAR WEIGHT OF AMMONIA = 17. MOLECULAR WEIGHT $\text{NO} = 30$. SO IN PERFECT WORLD 1 TON AMMONIA WOULD REMOVE 2.8 TONS OF NO_x . SNCR STOICHIOMETRY VARIES BETWEEN 0.35 & 1.0. SO 1 TON AMMONIA = 1 TON NO_x IS REASONABLE. I HAVE HEARD THAT NUMBER HERE & PREVIOUS CONFERENCES MANY TIMES. ASSUMING \$500/TON OF AMMONIA WHICH IS PLenty & ADDING AN ADDITIONAL 50% FOR OTHER OPERATING COSTS, O&M PER TON REMOVED WOULD BE \$750/TON. TOTAL VARIABLE O&M WOULD BE \$1,375,000. THIS IS ON HIGH END OF WHAT IS CURRENTLY BEING REPORTED

9. FIXED O&M COST FOR SCR WAY TO HIGH. ALSO, ROUGH ESTIMATE ~~BE~~ FOR CATALYST FROM CORMATECH FOR IPP UNIT IS \$5,000,000 FOR THREE LAYERS ($16,000 \text{ m}^3$). HE RECOMMENDED INSTALLING FOURTH LAYER AFTER 3-YEARS & THEN REPLACING ONE LAYER EACH YEAR AFTER, SO CATALYST COST WOULD BE $\approx \$1.5\text{m}/\text{UNIT}/\text{YEAR}$ THERE IS VERY LITTLE MAINT. W/SCR'S OTHER THAN CATALYST. SO LETS USE ~~\$5,000,000~~ \$2,000,000/UNIT/YEAR. I COULD EVEN LIVE WITH \$5,000,000 FOR STATION BUT, \$12,000,000 IS TOO HIGH.
10. VARIABLE COST OF SCR IS ALMOST ENTIRELY COST OF AMMONIA REAGENT PLUS INCREASED FAN COST. AMMONIA COST PER YEAR WILL BE $13,594 \text{ TONS OF NO}_x / 2.8 \text{ TONS AM} / \text{TONS NO}_x \times \$500/\text{TON} = \$2,427,500$. EXPECTING ABOUT 5" H_2O DUCT PRESSURE INCREASE DUE TO SCR'S. EXACT ECONOMICS FOR FAN COST UNKNOWN BUT PROBABLY IN REALM OF \$4-5m/YEAR. THIS MEANS PARSONS ESTIMATE IN BALL PARK BUT MAY BE HIGH BY 50%.
11. IT APPEARS TO ME THAT PARSONS TRIED TO APPLY \$/KW ACROSS THE BOARD FROM SMALLER PLANTS. THAT WORK OK FOR CAPITAL COSTS BUT GROSSLY SKEWS O&M COSTS. O&M COSTS SHOULD BE BASED ON TONS/YEAR REMOVED SINCE IT IS A CHEMICAL COST BASED ON CHEMICAL REACTION NOT CONSUMPTION.
12. I PICKED UP SOME SOFTWARE FROM DOE THAT MODELS ALL COSTS OF POLLUTION CONTROL. IT DID NOT LOOK TOO HARD TO SET-UP. I WILL USE THAT TO VERIFY MY CALCULATIONS WHEN I GET BACK.

Jerry

From: Rand Crafts
To: mradulov@deq.state.ut.us
Date: 6/9/02 5:28PM
Subject: WEPCO Notes for Meeting 6/11/02

Milka,

In preparation for Tuesday's meeting, we have had the following discussion compiled. Please review so we can talk about it further. Thanks,

Rand Crafts
Intermountain Pwer Service Corp
435-864-6494
435-864-0994 fax
rand-c@ipsc.com

DISCUSSION ON WEPCO REPORTING

We have been looking at the issue of whether the WEPCO Rule's requirement for five-year post-modification monitoring and reporting of emissions should commence when certain modifications to Units 1 and 2 which increase the heat input begin or when they are completed. IPSC believes that the language of the WEPCO Rule and EPA's interpretations of the Rule indicate that the reporting period begins upon completion of the modification.

It is our understanding that both the amended Approval Order and the revised Operating Permit for Units 1 and 2 require the reporting of emissions for a five-year period following certain modifications to the units which result in an increased heat input. The Utah Division of Air Quality ("DAQ") has informally indicated that this reporting period begins when the work on the modifications begins, not when the work has been completed. Presumably, this conclusion is based at least in part on the fact that the units continue to operate during the period in which the modifications are under way, with intermittent periods of increased heat input. A fuller explication of the details of the modification and conditions of the Approval Order and Operating Permit that are at issue is found in the draft letter to Rick Sprott, Director of DAQ, which we forwarded to you earlier.

In August 2001 (over nine years after the WEPCO Rule was promulgated), the Utah Division of Air Quality incorporated the WEPCO Rule into the Utah Air Quality Rules. The post-modification reporting provision is found in the definition of "Actual Emissions" in the Utah Air Quality Rules, and reads as follows:

(4) For an electric utility steam generating unit (other than a new unit or the replacement of an existing unit) actual emissions of the unit following the physical or operational change shall equal the representative actual annual emissions of the unit, provided the source owner or operator maintains and submits to the executive secretary, on an annual basis for a period of 5 years from the date the unit resumes regular operation, information demonstrating that the physical or operational change did not result in an emissions increase. A longer period, not to exceed 10 years, may be required by the executive secretary if the executive secretary determines such a period to be more representative of normal post-change operations. (UAC R307-101-2)

The federal counterparts this provision are found at 40 CFR 51.165(a)(1)(xii)(E) and 52.21(b)(21)(v).

Both the Utah and EPA post-modification reporting requirements specify that the reporting is for emissions "following" the modification and is for the five-year period "from the date the unit resumes regular operations." An interpretation of this provision which would require that the reporting include the

time before the modifications are complete would be inconsistent with the plain meaning of the word "following" and would result in reporting before the resumption of "regular" operations. In addition, the period before the completion of the modifications is not representative of normal operations following the modifications.

The preamble to the WEPCO Rule, EPA made the following statement regarding post-modification emissions reporting:

Appropriate records are to be submitted to the permitting agency on an annual basis for a period of 5 years from the date the unit begins operations (i.e., post-change operations after an initial shakedown period). A longer period, not to exceed 10 years, may be required by the permitting agency where it has determined that no period within the first 5 years following the change is representative of source operations. (57 Fed. Reg. 32314, LEXIS at 28 (July 21, 1992))

To require reporting of emissions prior to the completion of the modification is inconsistent with the foregoing. The reference to the "initial shakedown period" is a clear indication that the reporting is to be of emissions following the completion of all the work on the modification.

This conclusion is reinforced in a Federal Register notice seeking comments on certain changes to the New Source Review rules. ("Notice of Availability; Alternatives for New Source Review (NSR) Applicability for Major Modifications; Solicitation of Comment," 63 Fed. Reg. 39857 (July 24, 1998).) In that notice, EPA sought comments on extending the five-year tracking requirement for future actual emissions to ten years. The notice states that the purpose of the reporting period is to "encompass all increases in capacity utilization that could result from a particular change. (63 Fed. Reg. 39857, 39859) EPA further suggested that ten years might be "appropriate for tracking future actual emissions after a change."

The WEPCO post-modification reporting requirement is addressed in EPA's Detroit Edison determination, in which EPA determined that a dense pack turbine project at Detroit Edison's Monroe Plant was not a major modification:

The PSD regulations also require Detroit Edison to maintain and submit to the delegated permitting agency, for a period of five years from the date the units resume regular operation following completion of the Dense Pack project, information demonstrating that the project did not result in an emissions increase. (Letter dated May 23, 2000 from Francis X. Lyons, Regional Administrator, EPA Region 5, to Henry Nickel, Counsel for the Detroit Edison Company, Enclosure at 21.)

Similarly, in a letter from EPA Region 8 concerning Otter Tail Power Company's Low Pressure Rotor Upgrade Project, EPA stated:

If Otter Tail utilizes the "representative actual annual emissions" methodology to determine that the facility is not subject to PSD, appropriate records must be submitted to the North Dakota Department of Health on an annual basis for 5 years from the date the unit begins operations after an initial shakedown period. (Letter dated April 17, 2001 from Richard R. Long, Director, Air and Radiation Program, U.S. EPA Region 8, to Gary D. Helbling, Environmental Engineer, North Dakota Health Department, Attachment A.)

The preamble to the WEPCO Rule addresses the types of information that may be used for the reporting:

Utilities may use continuous emissions monitoring data, operational levels, fuel usage data, source test results or any other readily available data of sufficient accuracy for the purpose of documenting a unit's post-change actual annual emissions. (57 Fed. Reg. 32314, LEXIS at 28.)

Given that the question is whether a modification results in a significant annual emissions

increase (as measured in tons per year), the first report would not be until one year's data is collected following the completion of the modification.

In short, the WEPCO Rule clearly contemplates reporting of actual annual emissions for the five-year period following the completion of the modifications and the commencement of regular operations of the modified facility. To require reporting of emissions after the beginning but before the completion of work on the modifications would not yield data representative of normal operations.

CC: Blaine Ipson